
State of California
The Resources Agency
Department of Water Resources

**SP-T10 EFFECTS OF PROJECT FEATURES,
OPERATIONS AND MAINTENANCE ON UPLAND
PLANT COMMUNITIES
DRAFT FINAL REPORT**

**Oroville Facilities Relicensing
FERC Project No. 2100**



AUGUST 2004

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Preliminary Information – Subject to Revision – For Collaborative Process Purposes Only

REPORT SUMMARY

Current and future operations of the Oroville Facilities may impact upland plant communities, including rare or unique community types. These impacts can be from any project-related activity that alters, degrades, destroys, or enhances habitat features necessary to support that plant community type. Changes in land use, maintenance and operation activities, or recreational use of an area could potentially affect plant communities.

Upland plant communities occupy approximately 14,084 of the 41,000 acres within the Project area. Approximately half (19,796 acres) of the 41,000 acres are covered by Project waters. Upland communities in this area consist of forest/woodland, shrub, scrub, and herbaceous vegetation types. Approximately 11,100 acres of woodlands, 232 acres of chaparral shrub vegetation, and 2,750 acres of grasslands occur in the Project area.

These vegetation types are habitat for a number of special status plant species, most of which inhabit openings in woodland habitats. As these communities mature, densities increase and grassy openings decrease. Overall, 76% of the upland shrub and woodlands communities within the Project boundary currently have dense canopy closures of more than 60%.

Elimination of widespread low- to moderate-severity fires has affected the structure and composition of most Sierra Nevada vegetation, especially in low to middle elevation forest. Findings by SNEP (1996) indicate that the annual area burned during the twentieth century was reduced to approximately 10% and 3% of presettlement values for the blue oak and mixed conifer forest types, respectively. These changes are most obvious in stand densities and decreased biodiversity. These conditions have created conditions favorable to more intense and severe fires which tend to be more devastating to natural communities. Vegetation in this area is believed to have evolved under specific fire regimes and much of the vegetation exhibits traits that allow survival and reproduction in an environment of regular fire. Most presettlement fires were low to moderate severity with only a few patches of high severity fires, with return intervals of 8 years in blue oak/foothill pine communities and 11-15 years for Ponderosa pine and mixed conifer/pine communities (SNEP 1996). Higher severity fires and high return intervals tend to deplete the native flora and increase non-native species.

A variety of techniques are used to reduce fuel loads and increase biodiversity and health of natural communities. These include prescribed burns and biomass reduction techniques such as mastication, chipping, thinning, and herbicide application.

Project related activities that may affect upland plant communities include maintenance activities for project facilities, roads, and recreation facilities as well as recreational use activities by the general public. Effects to upland communities can result in direct and indirect loss of plant communities including direct loss of habitats and indirect impacts from non-native species.

Potential measures to limit impacts to upland plant communities within the Project area from Project-related activities and current and future recreational use and/or development include:

- Avoid siting new recreational/project facilities within areas mapped as sensitive resource area for plants and wildlife (CDWR 2004f)
- Minimize loss to natural communities by citing new facilities in areas that currently have some level of disturbance
- Retain mature trees and shrubs
- Minimize loss to areas with a notable number of native perennial bunchgrasses
- Minimize or eliminate use of non-native species in landscaping – use drought tolerant native plant species
- Revegetate and/or restore native plant habitats within disturbed areas
- Support prescribed burns and/or biomass reduction techniques on wildlands adjacent to and in the vicinity of urban areas

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1.0 INTRODUCTION

1.1 BACKGROUND INFORMATION

Current and future operations of the Oroville Facilities may impact upland plant communities, including rare or unique community types. These impacts can be from any project-related activity that alters, degrades, destroys, or enhances habitat features necessary to support that plant community type. Changes in land use, maintenance and operation activities, or recreational use of an area could potentially affect plant communities.

An assessment and analysis of project-related impacts on plant communities can provide program managers and stakeholders with the information necessary to identify those management options or project modifications, which minimize project-related impacts.

1.1.1 Statutory/Regulatory Requirements

In addition to meeting Federal Energy Regulatory Commission guidelines, the information provided in this report is required for compliance with State and federal environmental regulations.

1.1.2 Study Area

The study area for this investigation includes the Oroville Facilities Relicensing FERC Project boundary.

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. The Oroville Facilities are also operated for flood management, power generation, to improve water quality in the Delta, provide recreation, and enhance fish and wildlife.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal,

Oroville Wildlife Area (OWA), Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, and transmission lines, as well as a number of recreational facilities. An overview of these facilities is provided on Figure 1.2-1. The Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-feet (maf) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level.

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cfs and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam four miles downstream of the Oroville Dam creates a tail water pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cubic feet per second (cfs) of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. The Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into the Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery was intended to compensate for spawning grounds lost to returning salmon and steelhead trout from the construction of Oroville Dam. The hatchery can accommodate 15,000 to 20,000 adult fish annually.

The Oroville Facilities support a wide variety of recreational opportunities. They include: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, the Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Visitor Center and the OWA.

The OWA comprises approximately 11,000-acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000 acre area straddles 12 miles of the Feather River, which includes willow and cottonwood lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill day use area, model airplane grounds, three boat launches on the Afterbay and two on the river, and one primitive camping area. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

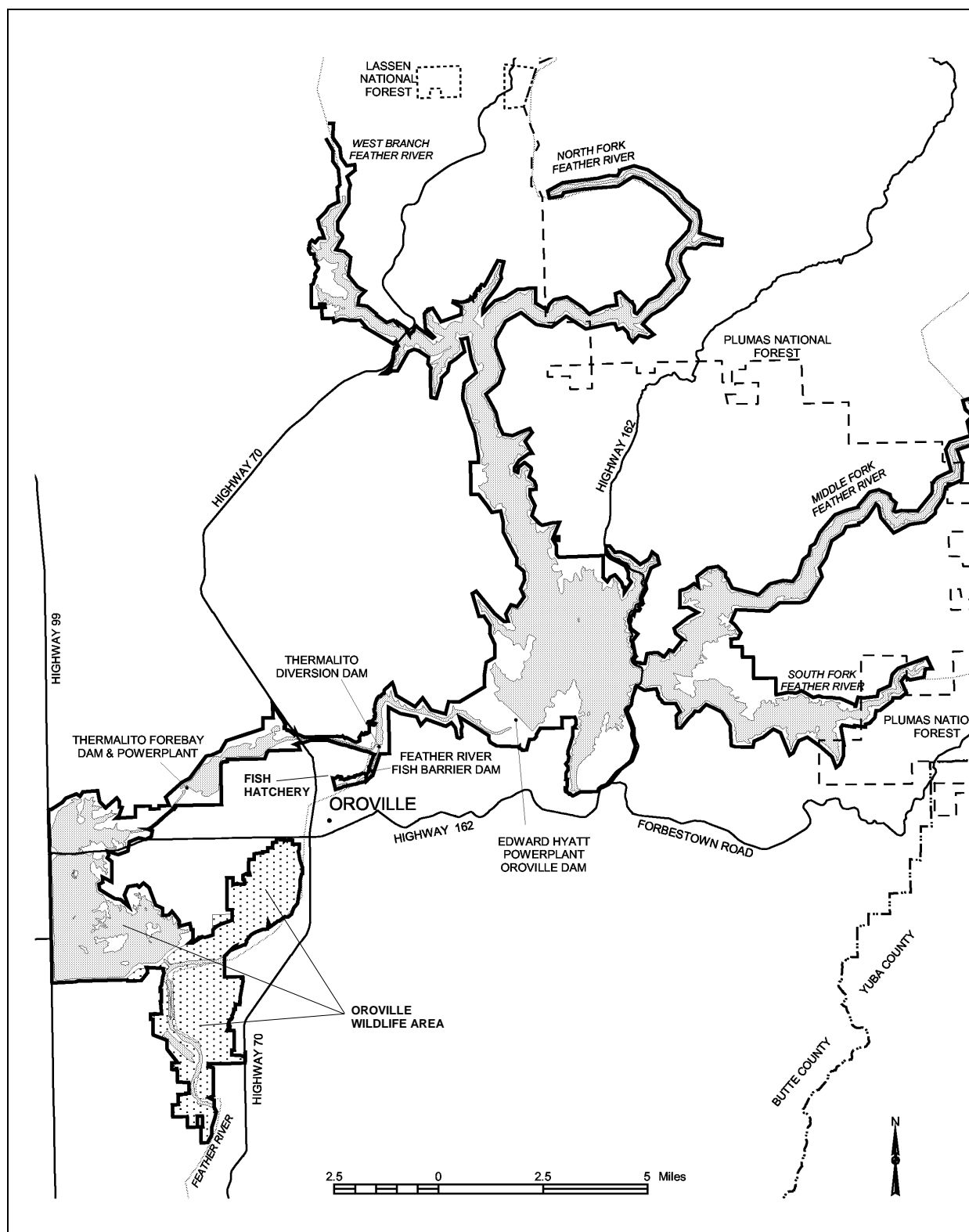


Figure 1.2-1. Oroville Facilities FERC Project Boundary

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1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, recreation, diversion and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning are conducted for multi-year carry over. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit draw down of the reservoir below that level. If hydrology is drier than expected or requirements greater than expected, additional water would be released from Lake Oroville. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum annual level of up to 900 feet above mean sea level (msl) in June and then can be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During drier years, the lake may be drawn down more and may not fill to the desired levels the following spring. Project operations are directly constrained by downstream operational constraints and flood management criteria as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG entitled, "Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife," sets criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.3.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the

Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become de-watered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for objectives, April through November.

There are several temperature objectives for the Feather River downstream of the Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warmwater fish.

The National Marine Fisheries Service has also established an explicit criterion for steelhead trout and spring-run Chinook salmon. Memorialized in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead as a reasonable and prudent measure; DWR is required to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure requires water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid May, and 59°F during the remainder of the growing season). There is no obligation for DWR to meet the rice

water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 (July 2002) af are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are designed for multiple use of reservoir space. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., wetness in the

watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

2.0 NEED FOR STUDY

This study is needed to comply with State and federal regulations. Identification and quantification of Project effects on botanical resources including plant communities has been identified as an issue by relicensing stakeholders. Evaluation of Project effects on botanical resources is required for California Environmental Quality Act/National Environmental Policy Act (CEQA/NEPA) compliance, and will be included in the Federal Energy Regulatory Commission (FERC) license application.

3.0 STUDY OBJECTIVE(S)

3.1 APPLICATION OF STUDY INFORMATION

3.1.1 Environmental Documentation

The objectives of this study are to:

- provide information on the botanical resources relating to plant communities in the project vicinity
- assess the effects of project management and operations on upland plant communities
- provide information that can be used to identify opportunities for protection, mitigation, and enhancement measures

Information provided in this report will be included in the FERC license application. It is also required for compliance with State and federal environmental regulations.

3.1.2 Settlement Agreement

This study provides information that will be used to develop Resource Actions that address plant communities and habitats in the Project area.

4.0 METHODS

4.1 EXISTING CONDITIONS

Data was collected and reviewed on the status of and factors affecting existing upland vegetation communities in the Project vicinity. Information on vegetation communities was obtained from the vegetation cover type mapping produced in *SP – T4: Biodiversity, Vegetation Communities and Wildlife Habitat Mapping – Draft Final Report* (CDWR 2003a). Information on special status plants species habitats and distributions within the Project area was obtained from *SP – T2: Project Effects on Special Status Plant Species* (CDWR 2004a). Information on non-native plant species including noxious weed locations, dispersal, project effects, and management options in the Project vicinity was obtained from *SP – T7: Project Effects on Noxious Terrestrial and Aquatic Plant Species* (CDWR 2004b).

4.1 FIRE SUPPRESSION AND FUELS MANAGEMENT

A review of the ecological role of fire in the evolution of plant communities in the Project vicinity was conducted. Information was collected on the history of fire suppression and its effects on plant communities. The recent fire history of the Project vicinity was reviewed with regard to changes in plant communities, vegetation associations, and community structure. A literature review was conducted on the effects of fire management and mechanical thinning of chaparral and woodlands communities with regards to vegetative structure, special status species habitat enhancement, and control of non-native species.

4.2 PROJECT RELATED ACTIVITIES

Information was collected and reviewed on project related activities that have the potential to affect upland plant communities in the Project area. Project related activities include maintenance and operations, recreation, and pest management. Information was obtained from DWR, DFG, and DPR maintenance staff. Information was collected on the location, type, frequency, duration, and method of maintenance activity and or pest management.

5.0 RESULTS

5.1 EXISTING CONDITIONS

5.1.1 Vegetation

The Project area is located both within the Sacramento Valley and Sierra Nevada Foothills subregions of the California Floristic Province (Hickman 1993). Vegetation patterns in this area correspond with elevation changes from the valley floor to the upper elevations of the mountain range in the Project area, ranging from valley grasslands to foothill woodlands (characterized by blue-oak/foothill pine woodlands with varying amounts of chaparral) to mixed conifer forests in the higher elevations. Within the foothill regions, vegetation patterns and associations are strongly influenced by slope, aspect, soils, and disturbance history.

The primary parent rock types (which influence soil development) around Lake Oroville are granitic, volcanic, metamorphic, and sedimentary. On the surface, this substrate includes many rock outcrops and some very thin to deep soils. Slopes are extremely variable, ranging from undulating in the lower reaches around the dam to very steep, rugged topography upstream in each of the arms of the lake. The West Branch and Big Bend area of the North Fork arm of the lake are criss-crossed by narrow bands of serpentine within metasedimentary and metavolcanic formations. Both the Middle Fork and the South Fork arms of the lake are underlain by granitic rock.

Below Lake Oroville where the toe slope of the foothills meet the Great Valley, the topography flattens dramatically into gently undulating alluvial soils and gravel deposits laid down by the Feather River and older streams. Vernal pools and swale complexes are a common part of the valley grassland habitats in this area. These pools are of the Northern Hardpan type that occurs in areas of hummocky ground on terrace-alluvial derived Redding soils.

Upland plant communities occupy approximately 14,084 of the 41,000 acres within the Project area. These consist of forest/woodland, shrub/scrub, and herbaceous communities. Table 5.1-1 lists the acreages for the vegetation community types in the Project area. Twenty-one associations of upland woodland types, two associations of upland shrub/scrub types, and four associations of upland herbaceous types were identified within the Project boundary (Table 5.1-2).

Table 5.1-1. Upland plant community acreages within the study area.

	Project Area	One-Mile Buffer
Upland Forest/Woodland	11,100.5	62,145.0
Upland Herbaceous	2,751.5	12,217.9
Upland Shrub/Scrub	231.9	2,288.6
Total Acres	14,083.9	76,651.5

Table 5.1-2. Acreages of vegetation associations found within the study area.

	Vegetation Association	Acreage	
		Project Area	One-Mile Buffer
Upland Forest/Woodland			
	Black oak woodland	42.1	281.1
	Blue oak woodland	472.0	3397.2
	Blue oak woodland/chaparral	282.0	1142.0
	Blue oak-foothill pine woodland	408.6	1122.8
	Blue oak-foothill pine woodland/chaparral	670.2	1086.8
	Canyon live oak woodland	587.4	1256.0
	Douglas fir forest	169.6	2578.7
	Foothill pine woodland/chaparral	24.8	361.6
	Foothill pine-mixed oak woodland	981.6	3082.3
	Foothill pine-mixed oak woodland/chaparral	1425.3	4900.0
	Mixed conifer forest	0.0	854.3
	Mixed conifer-hardwood forest	355.0	3575.6
	Mixed oak woodland	1468.2	5294.1
	Mixed oak woodland/chaparral	1263.7	7076.1
	Mixed pine woodland/chaparral	7.0	305.5
	Mixed pine-mixed oak woodland	299.2	1345.0
	Mixed pine-mixed oak woodland/chaparral	994.6	7464.4
	Ponderosa pine forest	3.2	592.3
	Ponderosa pine-Douglas fir forest	112.5	2677.9
	Ponderosa pine-mixed oak woodland	950.4	6556.5
	Ponderosa pine-mixed oak woodland/chaparral	573.3	7043.3
	Valley oak woodland	9.8	151.6
Upland Herbaceous			
	California annual grassland	2201.7	10664.7
	Disturbed grassland	493.4	1541.4
	Short forbland	55.2	11.9
	Tall forbland	1.2	
Upland Shrub/Scrub			
	Mixed chaparral	132.6	980.6
	Whiteleaf manzanita chaparral	99.3	1308.0

5.1.1.1 Upland Woodland Communities

Approximately 11,100 acres of forest/woodland vegetation exists in the Project area. At the lower elevations around the Diversion Pool, Oroville Dam, Bidwell Canyon, and Potter Ravine, vegetation is composed mostly of blue oaks or mixed oaks in varying proportions with foothill pine woodland, open grasslands, and a small proportion of chaparral. Typical dominant species include interior and canyon live oaks (*Quercus wislizenii* and *Q. chrysolepis*), blue oak (*Q. douglasii*), foothill pine (*Pinus sabiniana*), whiteleaf manzanita (*Arctostaphylos viscida*), and buck brush (*Ceanothus cuneatus*). Approximately 1,100 acres of blue oak-foothill pine woodland with a chaparral component occur in the lower elevations around the Thermalito Diversion Pool and Oroville Dam. Foothill pine-mixed oak woodland/chaparral occurs on over 1,400 acres in the Project area and is common in the lower elevations around the mainstem of Lake Oroville.

The vegetation of the West Branch of the Feather River is heavily influenced by the criss-crossing of serpentine bands. At the southern end, blue oak woodlands continue in a mosaic with live oaks and grassy opening, but soon give rise to denser chaparral/mixed live oak habitats. Foothill pines drop out and are replaced with Ponderosa pines (*Pinus ponderosa*) and black oaks (*Quercus kelloggii*) as elevation and slope increase. Vegetation on the serpentine soils tends to be more xeric and open, supporting sparse foothill pine/chaparral.

Along the North Fork arm of Lake Oroville, north-facing slopes and narrow canyon sides give rise to a cool, moist environment and changes from xeric/brush vegetation to dense Douglas fir (*Pseudotsuga menziesii*)/Ponderosa pine/tanoak (*Lithocarpus densiflorus*) and other mixed hardwood/conifer types with black oaks, tanoaks, madrone (*Arbutus menziesii*) and very tall canyon live oaks.

Vegetation along the Middle Fork responds to a change to granitic rock and decomposed granitic soils. The vegetation of the south-facing slopes with open oaks, foothill pine, grass, and chaparral, starkly contrasts that of the north-facing slopes, with Ponderosa pine, live oaks, and black oaks. Farther up the canyon, the vegetation becomes mostly dense mixed conifer-hardwoods on the north-facing slopes and various more open fire-impacted Ponderosa pine-live oak-shrub types on the rocky south-facing slopes.

Vegetation along the South Fork also has contrasting vegetation on north and south-facing canyon walls. On the south-facing side, dense to moderately open mixed oak woodland with some chaparral gives way to dense to moderate Ponderosa pine/mixed oak woodland/chaparral with distance upstream. On the north-facing side, blue oak gives way to dense mixed oak stands and then to dense Ponderosa pine, mixed oak forest. Ponderosa pine/Douglas fir forests occur at the far eastern end.

5.1.1.2 Upland Shrub Communities

Shrub vegetation in the Project vicinity consists mostly of chaparral vegetation which is characterized by evergreen, tough waxy leaves. Chaparral is typically found on soils that are shallow, nutrient poor, rocky or gravelly in texture, and have a low water holding capacity.

Approximately 232 acres of chaparral occur within the Project boundary around Lake Oroville and the Thermalito Diversion Pool. However, chaparral was mapped as a component of eight oak/pine woodland/forest associations, thus inhabiting a portion of an additional 5,200 acres around the Lake.

Almost pure stands of whiteleaf manzanita chaparral occur on south-facing slopes with thin, rocky soils in the lower elevations. Mixed chaparral was more common on various exposures in lower to mid foothills and typically consists of whiteleaf manzanita (*Arctostaphylos viscida*), buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus berberidifolia*), and coffeeberry (*Rhamnus tomentella*). Herbaceous undergrowth is usually sparse in chaparral stands partly due to chemicals exuded by the chaparral shrubs and dense overstories.

5.1.1.3 Upland Herbaceous Communities

Approximately 392 acres of annual grasslands occur above the dam, usually as small openings among woodland, forest, and chaparral vegetation. At the lower elevations of the Project area below the Thermalito Diversion Pool, California annual grassland is the major upland vegetation type. Approximately 1,800 acres of annual grassland occur within the Project area around the Thermalito Afterbay and Thermalito Forebay. Vernal pools and vernal pool/swale complexes are a common part of the valley grassland habitats in this area and are discussed in further detail under SP-T3/5 (CDWR 2004c). Other upland herbaceous associations include disturbed grassland, short forbland, and tall forbland.

The grasslands in this area are comprised mostly of non-native annual grasses. They support a diverse mixture of annual, non-native and native grass and forbs. Non-native grasses, such as soft chess (*Bromus hordeaceus*), red brome (*B. madritensis* ssp. *rubens*), wild oats (*Avena* spp.), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), and rattail fescue (*Vulpia myuros* var. *myuros*) dominate this vegetation type. Annual native forbs are interspersed with the grasses, and include species such as lupine (*Lupinus* spp.), clarkia (*Clarkia* spp.), and popcorn flower (*Plagiobothrys* spp.). Various perennial bulbs such as brodiaea (*Brodiaea* ssp., *Dichelostemma* ssp. *triteleia* ssp.), Mariposa lily (*Calochortus luteus*), onion (*Allium amplexans*), and soap root (*Chlorogalum* ssp.) are also present. Some grassland areas are heavily infested with

the noxious weeds yellow starthistle (*Centaurea solstitialis*) and medusahead grass (*Taeniatherum caput-medusae*).

Native bunchgrasses, including purple needlegrass (*Nasella pulchra*), occur sporadically throughout the project vicinity. Patches of this vegetation occur occasionally in annual grasslands around the Thermalito Complex and in openings and along edges of foothill woodland communities above the Dam.

5.1.1.4 Unique Habitats – Serpentine and gabbro soils

Vegetation types that occur on soils derived from serpentinitic and gabbroic rock types include sparse grassland, chaparral, and woodlands. Serpentine-derived soils tend to have low levels of nitrogen, phosphorus, and calcium, combined with high levels of magnesium and potentially toxic elements such as nickel, chromium, and cobalt. Gabbro-derived soils tend to be mildly acidic and are rich in iron and magnesium and often contain other heavy metals such as chromium. These soil types support unique assemblages of plant species with many endemic species, including a high number of special status plant species. They usually support a high level of plant diversity as well as a low number of non-native plants and invasive species. Serpentine and gabbro soils in the Project area are potential and suitable habitat for the federally listed Layne's ragwort (*Senecio layneae*).

Approximately 172 acres of serpentinite and serpentine-derived soils occur in the Project area. Numerous northwest to southeast trending bands of serpentine occur in the North Fork and West Branch arms of Lake Oroville. Vegetation typically consists of sparse foothill pines and scattered chaparral shrubs. These outcrops harbor many endemic species including two special status plant species: cut-leaved ragwort (*Senecio eurycephalus* var. *lewisrosei*) and Butte County calycadenia (*Calycadenia oppositifolia*).

Approximately 64 acres of gabbro and gabbro-derived soils occur in the Project area along the South Fork arm of Lake Oroville. Plant species composition is similar to surrounding vegetation, typically a mix of moderate to dense foothill or ponderosa pine and mixed oak woodland. One special status species was observed on gabbro soils: Brandegee's clarkia (*Clarkia biloba* ssp. *brandegeae*).

5.1.2 Special Status Plant Species

No federally or State listed species were found during these studies. Habitat for the federally and State listed Layne's ragwort occurs in open areas of serpentine and gabbroic derived soils within chaparral and chaparral/open pine or oak woodlands. Suitable habitat is present on the serpentine soils along the West Branch and North Fork arms of Lake Oroville and on the gabbroic derived soils along the South Fork. Six of the twelve special status plant species (California Native Plant Society Lists 1, 2, and

3) that were found within the Project boundary during these studies occur in openings in foothill woodland/chaparral communities. These species and distributions are discussed in detail in *SP-T2 – Project Effects on Special Status Plant Species* (CDWR 2004a).

Butte County calycadenia was found in small to large grassy openings within woodland, chaparral, and forest environments. Brandegee's clarkia (*Clarkia biloba ssp brandegeae*) grows in small grassy openings in oak and pine-oak woodlands. White stemmed clarkia (*Clarkia gracilis ssp. albicaulis*) was found in grassy openings within open woodland and in large openings along dirt road fill, cutbanks, and road edge. Mosquin's clarkia (*Clarkia mosquinii*) was most abundant on the west side of the lake where wildfire has recently burned. It was mostly found in small grassy openings in mixed oak and pine/mixed oak woodlands. Cut-leaved ragwort (*Senecio eurycephalus var. lewisrosei*) was found on serpentine, in large and small grassy openings in foothill pine/mixed oak/chaparral. Dissected-leaved toothwort (*Cardamine pachystigma var. dissectifolia*) was found on a shady, steep slope in Ponderosa pine-mixed oak woodland. Butte County fritillary (*Fritillaria eastwoodiae*) was found within the mixed conifer-hardwood forest, Ponderosa pine-mixed oak woodland, mixed oak woodland, and foothill pine-mixed oak woodland/chaparral plant associations.

5.1.3 Noxious/Invasive Species

Nearly all plant communities within the Project vicinity have non-native plant species (including those rated as invasive or noxious weeds) as a component. Over 219 non-native species were identified within the Project boundary during these studies (CDWR 2004b). Although the number of rated weed species and infestations are substantially greater in lower elevation riparian and wetland areas than in upland communities, open woodlands have a large number of non-native species as a component of the understory and areas of disturbance along roads, etc. tend to harbor a large number of non-native species in chaparral and woodland communities. These include the rated pests, Spanish, Scotch, and French brooms as well as skeleton weed, Himalayan berry, tree of heaven, and starthistle.

5.2 FIRE MANAGEMENT

5.2.1 Ecological Role of Fire on Plant Communities

Fire is a natural evolutionary force that has influenced Sierra Nevada ecosystems including biodiversity, plant reproduction, vegetation development, insect outbreak and disease cycles, soil functions and nutrient cycling, gene flow, and ultimately, sustainability (Sierra Nevada Ecosystem Program [SNEP] 1996). Prior to Euro-American settlement, fires burned frequently in most oak woodland, shrub, and conifer

forest types of vegetation. These fires are thought to have been frequent (typically multiple times each century), covered large areas, burned for months at a time, and exhibited complex patterns of severity. Frequent surface fires in many vegetation types minimized fuel accumulation.

Vegetation in the Project vicinity of Thermalito Diversion Pool and Lake Oroville ranges from oak and oak/pine woodlands and chaparral at the lower elevations to Ponderosa pine and mixed conifer/hardwood forests in the upper elevations. Each of these vegetation associations has evolved over thousands of years under a specific combination of fire frequencies, intensities, and patterns referred to as “fire regimes”. Much of the vegetation in this area exhibits traits that allow survival and reproduction in this environment of regular fire (CDWR 2004d). Many plant species and most communities show evidence of adaptation to recurrent fire. In chaparral and mixed conifer communities, many plant species have life history attributes tied to fire for their reproduction. Fire-adapted traits include thick bark and fire-stimulated flowering, sprouting, seed release and/or germination. Fire also influences soil and forest floor processes and organisms by consuming organic matter and inducing thermal and chemical changes (Skinner and Chang 1996).

Chaparral communities are very closely associated with fire. Chaparral shrubs are extremely flammable due to their resinous foliage, accumulated standing dead branches, and leaf litter. Chaparral shrubs are highly adapted to fire by either re-sprouting from underground burls and/or by having seeds that are stimulated to germinate by extreme heat. Chaparral communities are also known for their “fire followers” or herbaceous species that only germinate following a fire.

Most California oaks possess one or more adaptations that allow them to tolerate infrequent fires. Mature trees of some species, including blue oak, tolerate light to moderate ground fires with little damage. More intense fires may kill the trees or create fire scars that facilitate invasion by wood decay fungi and lead to early mortality. Most all young California oaks resprout readily after topkill by fire and some species of live oaks crown sprout vigorously. In mixed conifer/hardwood forests, infrequent fires may be important in maintaining black oaks as a dominant or codominant species.

Although infrequent fires may be tolerated by most oak species, it is not required for regeneration or to maintain the dominance of the oak overstory. Frequent fires suppress oak reproduction, deplete energy reserves of mature trees, and facilitate conversion of woodlands and savannas to grasslands.

Native perennial grasslands may also have been maintained and stimulated by fires. Stands of purple needlegrass (*Nasella pulchra*) often increase after fire. Regeneration occurs from tillers at the soil surface, fragmentation of bunches, and/or by seedling establishment.

In mixed conifer forests, frequent fire-return intervals reduced the horizontal and vertical biomass in the forest, which regulated the severity of the fire at a low or moderate level and helped prevent crown fires (CDWR 2004d). These frequent fires are thought to have minimized fuel accumulation, keeping understories relatively free of small trees and other vegetation that could form fuel ladders, which allow fire to move into the main canopy.

The way that fire affects the landscape is largely a result of its frequency, spatial extent, and its magnitude. Most presettlement fires were low to moderate severity, with only a few patches of high severity fires. Fire-scar records in tree rings have shown variable fire-return intervals with median values consistently less than 20 years for the foothill, Ponderosa pine, and mixed conifer zones of the Sierra Nevada (SNEP 1996). Tree ring analysis for the blue oak/foothill pine communities show a fire return interval of 8 years and 11-15 years for the Ponderosa pine and mixed conifer/pine communities.

5.2.2 Fuels Management in Project Vicinity

The influence of Euro-American settlement initiated profound changes on vegetation communities and the role of fire in Sierra Nevada ecosystems (SNEP 1996). Many factors influenced changes in fire patterns in the Sierras over the last one and a half centuries. Following the influx of settlers in the mid 1800s, logging was undertaken initially to supply the mines and later to support the growing population. Typically, loggers harvested fire-resistant species and large trees, and these were replaced by a greater number of much more fire-susceptible smaller trees. Large quantities of debris left after logging led to severe fires. Indiscriminate burning by loggers, miners, sheepherders, and settlers during the latter part of the 1800s and early 1900s, induced legislation to suppress wildland fires and broadcast burning.

Fire suppression resulted in significant reductions in area burned by wildfires during the twentieth century. Findings by SNEP (1996) indicate that the annual area burned during the twentieth century was reduced to approximately 10% and 3% of presettlement values for the blue oak and mixed conifer forest types, respectively.

Elimination of widespread low- to moderate-severity fires has affected the structure and composition of most Sierra Nevada vegetation, especially in low to middle elevation forests. These changes are most obvious in increased stand densities and decreased biodiversity. Stands of shrub and forest communities have generally become denser and vertical fuels have become more continuous. These conditions have created conditions favorable to more intense and severe fires which tend to be larger, more difficult to suppress, and more devastating to natural communities.

In the 1960s the first steps were taken to reintroduce fire as a management tool to reduce fuel loads and fire hazards while restoring a process important for maintaining ecosystem functions. Today, a variety of techniques are used to reduce fuel loads that

include prescribed burns, pile burns, mastication, chipping, disking and mowing, thinning, grazing, and herbicide application. These fuel load reduction techniques are discussed in more detail in *SP-L5 Fuel Load Management Evaluation* (CDWR 2004d).

5.2.3 Recent Fire History

The California Department of Forestry and Fire Protection (CDF) maintains a database of fire occurrence. In 2002, CDF began mapping timber fires that were 10 acres or greater, brush fires that were 50 acres or greater, and grassland fires that were 300 acres or greater. Prior to 2003, only fires over 300 acres were mapped for all vegetation types. In recent years (since 1990), there have been large fires in the northern portion of Lake Oroville (e.g. "Bloomer" in 1999, "Concow" in 2000, "Poe" in 2001), a few fires in the Middle Fork ("Bean Creek" in 1999 and "Union" in 1999 and 2002), and a fire in the Loafer Creek area ("South" in 1999).

In SP-L5, the CDF Fuel Hazard Ranking System was used to determine the fuel hazard for land only within the study area (Project area plus ¼ mile beyond). This model uses vegetation type, density, ladder fuels, crown density, slope, fire history, etc. to describe current fuel load conditions and rank fuel hazard situations. The fuel ranking assigned by this model to the lands around the Thermalito Diversion Pool and Lake Oroville are high (32%) to moderate (22%) and very high (15%).

5.2.4 Vegetation densities

Upland forest/woodlands account for almost 11,000 of the 12,230 acres of lands within the Project boundary around the Thermalito Diversion Pool and Lake Oroville. Chaparral occupies approximately 230 acres and grassy openings within these communities account for 392 acres. Over 145 acres (63%) of the chaparral community are covered with dense stands of whiteleaf manzanita or mixed chaparral species (60 – 100% canopy closure). Over 5,200 acres of upland forest/woodlands contain a chaparral component. Thirty-seven hundred acres (72%) of the woodland/chaparral vegetation has a dense canopy closure and another 1138 acres (21%) have a moderate canopy closure (40 – 59%). Overall, 76% of the upland shrub and woodlands communities within the Project boundary have a dense canopy closure of more than 60% (Table 5.2-1).

Table 5.2-1. Upland vegetation canopy densities in Project area around Thermalito Diversion Pool : Lake Oroville.

Density*	Acreage	% of Upland Vegetation
Chaparral		
Dense	145	63
Moderate	30	13
Open	35	15
Sparse	23	10
Woodland		
Dense	8384	76
Moderate	1955	18
Open	485	4
Sparse	139	1
* Density = canopy closure: Dense = 60 - 100%; Moderate = 40 – 59%; Open = 25- - 39%; Sparse = 10 – 24%		

Areas that had recent fires were mapped from aerial photos taken in 1996 (before the fires) and from photos taken in 2002 (post fire). All areas had a general shift of density of canopy closure from dense (60-100%) to moderate (40 – 59%). Fewer changes were observed in the acreages of the vegetation with open to sparse canopy closures.

5.2.5 Natural communities management

Although, vegetation types such as chaparral, foothill woodlands, and mixed conifer forests evolved over time under a regime of periodic fires, fire suppression in the last century has altered these ecosystems and landscapes. These changes have influenced not only the overstory composition but also the shrub and herbaceous understory. The invasion of our wildlands by non-native plant species during this same period has compounded the changes in the natural communities and species composition.

According to Keeley (unpub. manuscript), shrublands such as chaparral are fire-adapted below a certain threshold of fire frequency. Resiliency is inversely related to fire return intervals of 10 to 20 years in chaparral. High fire frequency depletes the native flora and increases the non-native herbaceous species. Fire management must address the timing of burns in relation to the life cycles of plants, frequency, and intensity of the burn.

While much information has been developed relative to the effects of fire on coastal chaparral and on higher-elevation forested landscapes, few studies have been conducted or reported as to the effects of fire or mechanical thinning on thick chaparral

vegetation and oak woodlands such as is common around the Thermalito Diversion Pool and Lake Oroville. In addition, there is general lack of developed information on the response of understory herbaceous species to disturbance (both natural and human-caused) in chaparral type vegetation.

Many of the special status plant species in the Lake Oroville area grow in openings or in the partial shade of woodland communities. As canopy densities increase with stand age, habitat for these species decline. In response, many of these species are now found along openings created by roads and fire breaks.

Numerous studies indicate that there is an increase in species richness of forbs and grasses in naturally-occurring canopy openings, and areas where the canopy is opened by fire or mechanical removal. In quantitative studies on blue oak woodland, species richness was highest in area with lower canopy closures. These same studies concluded that oak woodlands in general had lower canopy closures and higher species richness than chaparral and annual grasslands (Jimerson et. al 2002). Thinning one-third to two-thirds of the canopy in very dense southern Sierra Nevada blue oak woodlands (2,700 ft elev.) resulted in a more diverse understory structure than the dense, unthinned blue oak stands (Standiford, et. al.). Overall species diversity increased in temperate forests following gaps created by certain herbicides, and understory diversity decreased with closing of maturing oak canopies (Newton, et. al. 2002). In the southern Sierra Nevada, species diversity and the number of non-native species increased markedly during several years after fire in both chaparral and coniferous forest (Keeley, et.al. 2003) not in reference section. In studies on the Mendocino National Forest, plant diversity peaked in the first year after fires, but declined with time (Isle, email comm).

Although some studies suggest an increase in species diversity in response to vegetation thinning, non-native species may make up a sizeable percentage of this increase. The outcome of any treatment may be influenced by several factors:

- Degree of physical ground disturbance caused by the treatment (ground disturbance can release propagules of some native species, but also tends to favor the establishment of non-native species)
- Time since previous disturbance/canopy opening, especially by fire
- Proximity to sources of weed seeds (blue oak savanna and open woodlands have a high percentage of non-native grasses and forbs – chaparral openings adjacent to these woodlands are more likely to be infested)
- Type of disturbance – fire vs. mechanical removal (fire tends to promote dormant species, whereas mechanical removal alone may result in mostly annual herbs and large influx of weedy non-native species)

5.3 PROJECT MAINTENANCE, OPERATION, AND RELATED ACTIVITIES

A number of project related activities have the potential to affect upland plant communities within the Project area. These include:

- Water level fluctuations
- Project maintenance activities
- Facilities enhancement
- Pest management
- Recreation related activities

5.3.1 Water Level Fluctuations – Lake Oroville

Lake Oroville stores winter and spring runoff that is released into the Feather River for project purposes. During normal and wet hydrologic years, the reservoir typically reaches its maximum level (900 feet) in June. In dry years, it may reach its maximum as early as March and will not completely fill. Typically, it reaches its minimum water level for the year in the September to January period, primarily as a function of fall precipitation. Water levels can fluctuate more than 100 feet during the course of a “normal” year, with about 250 feet being the most it has ever fluctuated. The record low elevation of the water level in Lake Oroville was 645 feet in September 1977. Daily reductions in lake levels due to flood control operations can be as much as four feet per day during the wet season. Daily decreases in water levels in July to September can be as much as two feet per day. In dry years, the reservoir may not reach full capacity, resulting in a band below the high water line that may not be inundated during this time and may not have any moisture after the rainfall evaporates.

Vegetation above the full-pool elevation consists of a variety of drought tolerant mixed oak woodlands, foothill pine-mixed oak woodlands, oak/pine woodlands with a mosaic of chaparral, and mixed conifer/hardwood forests. Within the drawdown zone, annual fluctuation of water levels hinders the establishment of vegetation, including both upland and riparian vegetation types. Impacts from fluctuating water levels above the full-pool elevation to upland woodland/forest and shrub communities are probably minimal. Some loss may occur annually from sloughing off of soils from wave action at the lake/vegetation interface.

5.3.2 Water Level Fluctuations – Thermalito Complex

Water released for daily peak power generation and pump-back operations results in minimal water level fluctuations in the Thermalito Diversion Pool, Power Canal, and Forebay, but results in a weekly cycle of water level fluctuation in the Thermalito Afterbay. Other releases from Lake Oroville result in an extreme annual cycle of water level change in Lake Oroville, but have little effect on the downstream facilities.

These consistent water levels in the Forebay and relatively minor fluctuations in the Afterbay have resulted in the establishment of a rather narrow wetland/riparian zone around the Forebay and over 900 acres of wetland habitat along the north and east edges of the Afterbay. Because these fluctuations are consistent year after year and retain the wetland margin, no impacts to the upland community (annual grassland) from fluctuating water levels occur.

5.3.3 Project Related Maintenance Activities

Project area land management agencies including CDWR, DFG, and DPR conduct a wide variety of maintenance activities within the Project area. Some of these activities have the potential to affect upland plant communities.

5.3.3.1 *Road and parking lot maintenance*

GIS data analyses identified approximately 870 acres of roads in the Project area. Maintenance activities associated with roads and parking areas vary. In general, road maintenance consists of maintaining the road base, controlling vegetation along roadsides, and cleaning ditches and culverts to insure drainage. Dirt and gravel roads are primarily maintained by grading. Herbicide treatments are infrequently used to supplement grading in some locations. The amount of roadside vegetation treatment varies by type of road and use. Mowing or herbicide use is conducted on an annual basis to control herbaceous vegetation along the shoulder of roads and trails. Woody vegetation is mechanically removed in some areas to improve site distances and public safety.

Road maintenance activities have the potential to affect upland plant communities through direct removal or herbicide spraying and by disturbance activities that tend to promote the establishment of non-native invasive species. Vegetation communities immediately adjacent to disturbed areas usually have a high percentage of non-native species.

5.3.3.2 *Herbicide use*

Herbicides are used in several locations in the Project area by DWR, DPR, and DFG staff to control vegetation for noxious weed control, public safety, fuels management, and to control weeds around project facilities. Overspray may affect some upland vegetation in the immediate vicinity of treatment.

5.3.3.3 Transmission Line Right-of-Way

Approximately 11.2 miles of overhead transmission lines are included in the Project license and require regular trimming of trees to maintain vegetation clearances. These transmission lines include:

- The BUS line, a 230-kV overhead transmission line extending 9 miles from the Hyatt Powerplant Switchyard to PG&E's Table Mountain Substation.
- A 230-kV overhead transmission line that extends approximately 2.3 miles from the Thermalito Switchyard to PG&E's Table Mountain Substation.

The majority of the transmission line corridor is located in annual grassland habitats and do not require vegetative treatment or other regular maintenance activity other than inspections. However, the BUS line crosses oak and foothill pine vegetation between the Hyatt Switchyard and south Table Mountain. In keeping with the conditions of the existing license, DWR clears woody vegetation within the transmission line corridor to reduce fire danger. This includes pruning or topping trees by mechanical means within 30 feet of the transmission lines. The slash is piled nearby to provide wildlife cover.

Maintenance activities are kept within the established transmission line corridor. Although trees and shrubs are cleared as they encroach into the corridor, additional plant habitats are not affected. Maintenance machinery may help spread the seeds of noxious/invasive weeds, however, much of the area within the corridor is annual grassland and is already dominated by non-native annual grass and forb species. Disturbance edges tend to be the primary initial establishment area for many noxious species. This long corridor may provide a considerable amount of disturbed edge effect for non-native species such as Spanish and French brooms to become established.

5.3.4 Recreation Related Activities

5.3.4.1 Recreation Facilities

Recreation within the Project areas includes recreational facilities and opportunities, including boating, fishing, camping, and hiking (CDWR 2003b). Camping facilities include fully developed campgrounds to more primitive sites, including boat-in campsites. There are two marinas, nine boat ramps, five car-top boat ramps and a visitor's center located near Lake Oroville. Other recreation features include hiking trails, picnicking and swimming areas, and bicycle and horse trails. Additional recreation and visitor facilities are located at the Thermalito Forebay, Thermalito Diversion Pool, Thermalito Afterbay, and Oroville Wildlife Area.

DWR, DPR, and DFG conduct maintenance activities within the Project area associated with these recreation areas. GIS data analysis identified approximately 870 acres of

roads (some of which are related to recreation sites and activities) and 90 acres of trails in the Project area. Maintenance activities include surface repair and vegetation management by pruning, removal, and/or herbicide treatment.

Recreational use impact studies (CDWR 2004e) indicate that there were few signs of damage to upland vegetation at developed recreation sites, although, there were some moderate impacts at the Afterbay Outlet and the Stringtown Car-top Boat Ramp. Impacts to upland vegetation from dispersed recreation were highest from user-defined trails. Most were in steep areas leading to the water's edge of Lake Oroville which in turn has created problems from soil erosion. Direct damage to vegetation was also noted as a moderate concern at dispersed recreation sites, especially at Stringtown Car-top Boat Ramp. Vegetation damage was not noted to be of concern along any of the established hiking and bike trails.

5.4 MEASURES TO MINIMIZE IMPACTS TO NATIVE UPLAND COMMUNITIES

A number of measures have been identified that may reduce impacts to upland plant communities within the Project area from Project-related activities and current and future recreational use and/or development;

- Avoid siting new recreational/project facilities within areas mapped as sensitive resource area for plants and wildlife (CDWR 2004f)
- Minimize loss to natural communities by citing new facilities in areas that currently have some level of disturbance
- Retain mature trees and shrubs
- Minimize loss to areas with a notable number of native perennial bunchgrasses
- Minimize or eliminate use of non-native species in landscaping – use drought tolerant native plant species
- Revegetate and/or restore native plant habitats within disturbed areas
- Support prescribed burns and/or biomass reduction techniques on wildlands adjacent to and in the vicinity of urban areas

6.0 DISCUSSION

Upland plant communities occupy approximately 14,084 of the 41,000 acres within the Project area. Approximately half (19,796 acres) of the 41,000 acres are covered by Project waters. Upland communities in this area consist of forest/woodland, shrub, scrub, and herbaceous vegetation types. Approximately 11,100 acres of woodlands, 232 acres of chaparral shrub vegetation, and 2,750 acres of grasslands occur in the Project area.

These vegetation types are habitat for a number of special status plant species, most of which inhabit openings in woodland habitats. As these communities mature, densities increase and grassy openings decrease. Overall, 76% of the upland shrub and woodlands communities within the Project boundary currently have dense canopy closures of more than 60%.

Elimination of widespread low- to moderate-severity fires has affected the structure and composition of most Sierra Nevada vegetation, especially in low to middle elevation forest. Findings by SNEP (1996) indicate that the annual area burned during the twentieth century was reduced to approximately 10% and 3% of presettlement values for the blue oak and mixed conifer forest types, respectively. These changes are most obvious in stand densities and decreased biodiversity. These conditions have created conditions favorable to more intense and severe fires which tend to be more devastating to natural communities. Vegetation in this area is believed to have evolved under specific fire regimes, much of the vegetation exhibits traits that allow survival and reproduction in an environment of regular fire. Most presettlement fires were low to moderate severity with only a few patches of high severity fires, with return intervals of 8 years in blue oak/foothill pine communities and 11-15 years for Ponderosa pine and mixed conifer/pine communities (SNEP 1996). Higher severity fires and higher return intervals tend to deplete the native flora and increase non-native species.

A variety of techniques are used to reduce fuel loads and increase biodiversity and health of natural communities. These include prescribed burns and biomass reduction techniques such as mastication, chipping, thinning, and herbicide application.

Project related activities that may affect upland plant communities include maintenance activities for project facilities, roads, and recreation facilities as well as recreational use activities by the general public. Effects to upland communities can result in direct and indirect loss of plant communities including direct loss of habitats and impacts from non-native species.

Potential measures to limit impacts to upland plant communities within the Project area from Project-related activities and current and future recreational use and/or development are identified in Section 5.4 of this report.

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